1997

Safe Farm: The Impact of an Iowa Public Information Campaign

Lulu A. Rodriguez
Iowa State University

Charles V. Schwab
Iowa State University, cvschwab@iastate.edu

Jane W. Peterson
Iowa State University

Laura J. Miller
Iowa State University

Safe Farm: The Impact of an Iowa Public Information Campaign

L. A. Rodriguez, C. V. Schwab, J. W. Peterson, L. J. Miller

Abstract

The 1992 public information campaign, Safe Farm, made farm safety messages available to a diverse and independent target audience of 104,000 full-time and part-time Iowa farm operators and their families. The print portion of the campaign reached 5.03 million Iowa newspaper subscribers. A series of public service announcements received at least 180 h of air time on more than 100 Iowa radio stations and nearly 80,000 farm safety publications were distributed by Iowa State University (ISU) Extension during the campaign.

The impact of this public information campaign was measured by a baseline and follow-up telephone survey of 460 Iowa farm operators. The baseline survey showed that farm operators relied heavily on local media for farm safety information, as well as the cooperative extension service. When asked where they obtained safety information, 95% of the respondents said newspapers and magazines, 82% radio, 77% television, 59% relied on publications from ISU Extension, and 33% relied on ISU Extension staff.

The follow-up survey measured significant improvements in Iowa farm operators' awareness, concern, and behavior based on three indices composed of scales common to both surveys. A multiple regression analysis was conducted based on a causal model. The multivariate test indicated that these changes could not be statistically attributed to the Safe Farm campaign.

Keywords. Extension program, Agricultural workers, Safety, Injury prevention.

Although research on public service-oriented media campaign effects has a long tradition, the area went through a period of relative dormancy until fairly recently. The dormant period was related to inferences from previous research that media campaigns were apt to have few if any effects, and when such effects do occur, they were likely to be among particular segments of the population who were primarily seeking reinforcement of their already existing attitudes and behaviors (Klapper, 1960). Consequently, studies on the persuasive effects of public information campaigns are few.

Presented as ASAE Paper No. 93-1491. Funding for the information reported in this article was provided by the National Institute for Occupational Safety and Health (NIOSH) under the Agriculture Health Promotion Systems cooperative agreement. Journal Paper No. J-16420 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa. Project No. 3315.

The authors are Lulu A. Rodriguez, Assistant Professor, Journalism and Mass Communication Department, Charles V. Schwab, *ASAE Member Engineer*, Associate Professor, Agricultural and Biosystems Engineering Department, Jane W. Peterson, Professor, Journalism and Mass Communication Department, and Laura J. Miller, Communications Specialist, Extension Communication, Iowa State University, Ames, Iowa. Corresponding author: Charles Schwab, Iowa State University, 206A Davidson Hall, Ames, IA 50011-3080; tel.: (515) 294-6360; fax: (515) 294-9973; e-mail: <cvschwab@iastate.edu>.

Research endeavors over the past decade have led to substantially revised conceptions of the kinds of effects media are capable of having on individual and social behavior. Perhaps two of the most notable examples involve the examination of the effects of violent media portrayals on the aggressive behavior of audience members (NIMH, 1982) and the effects of political media content, especially during election campaigns (O'Keefe and Atwood, 1981). In both instances, the empirical evidence is clearly supportive of the media having the potential for doing more than simply reinforcing the psychological status quo among audience members.

One difficulty of the very few recent research studies on campaigns has been the lack of consistent conceptual or theoretical perspectives to guide development and design. However, as more data-centered evaluative studies continue to contradict the earlier limited effects-related hypotheses, more elaborate models surely will be developed. This study is a step toward that direction. It is based on the assumption that it is critical to investigate the contingencies under which different media messages result in different effects and at different points in time. That is, media effects are unlikely to be found en masse, or to be attributable to any set of factors. Rather, it may be more important to determine which factors are most operative in given communication situations involving given audiences.

Objectives

This collaborative study aims to (1) identify meaningful patterns of exposure to the campaign; (2) link these exposure and attention patterns to relevant antecedent factors, including demographic and other operator characteristics, such as personal work effort and type of farm operation, as well as farm operators' orientations toward farm safety, farm accident prevention, and relevant communication behaviors; and (3) examine the possible effects and consequences of the campaign messages both in and of themselves and as a function of their interactions with antecedent factors. This project expects to inform policy makers and safety specialists on ways to improve the quality of life of a dwindling rural population, and communication campaign planners about effective strategies to reach an important rural base about a critical farm issue. In short, this study deals with the summative evaluation of a year-long information campaign.

The Problem

The United States has more farm accidents than other industrialized nations, but few laws and programs to protect farm workers (Skromme, 1990). Education and enforcement strategies that resulted from the 1971 Occupational Safety and Health Act have reduced the death rate in the fields of mining and construction. Approximately 90% of U.S. farms, however, remain untouched by this policy initiative. Consequently, while occupational casualties have plunged more than 70% since 1945 in the construction, mining, manufacturing, and other industries combined, the death rate has only declined by 24% in agriculture.

The absence of education and information efforts has been particularly disturbing. Although tragic farm injuries have been well publicized in recent years (Oskam, 1993), few people understand the risk associated with agricultural hazards (Layde, 1990). This lack of risk information in an inherently dangerous farm environment is exacerbated by “myths” that have hindered the success of farm safety programs (Skromme, 1990). Farmers perceive, for example, that to be safe costs time and money, and that some risks are more imminent than others.

Farmers, too, seem to ascribe greater danger to the seasonal use of agricultural chemicals, many of which are applied by professionals, than to the daily use of farm machinery that causes far more acute injuries. Worse, these injuries are written off as an unavoidable, tragic aspect of agriculture (Rosenblatt and Lasley, 1991; Aherin et al., 1990). These self-defeating beliefs make safety education critical, especially on family-operated farms where people of all ages confront hazardous situations during work and leisure activities (Aherin et al., 1990; Contant, 1991; Oskam, 1993; Lexau et al., 1993).

Burke (1987) elaborates on this barrier to successful agricultural safety programs:

> *Agriculture has made progress over the years, but less than other major industries. Perhaps those of us in farm safety have the toughest job of all: an industrial safety director can order compliance with company safety rules, while a farmer can tell us to go fly. So our job becomes one of persuasion, of informing, of selling, of advising and providing farmers with the best possible tools to help him or her do the job safely, economically and well.*

The Campaign

This study evaluates the impact of the Safe Farm public health communication campaign produced by Iowa State University (ISU) Extension. The goal was to make farm safety messages available to a target audience of 104,000 full-time and part-time Iowa farm operators and members of their families through the most cost-effective, available channels. The campaign consisted of recorded public service announcements (PSAs) about a different aspect of farm safety sent every month to Iowa radio stations. Media releases on the same topics also were provided for extension staff in 99 counties to use in local media. These were meant to reinforce radio messages and to promote requests for and use of a series of monthly extension publications about farm safety.

The print portion of the campaign reached 5.03 million Iowa newspaper subscribers. The PSAs received at least 180 h of free air time on more than 100 radio stations. As a result, nearly 80,000 farm safety publications were distributed by ISU Extension upon request.

The campaign included monthly taped radio PSAs mailed to 116 AM and FM radio stations in Iowa. Each month's mailing included long (60 s) and short (30 s) versions of two messages about a different farm hazard. The first message focused on the frequency in which farm injuries from a certain hazard occurs in Iowa; the second message focused on a common situation that often leads to injuries from that hazard.

At the same time, extension education directors in Iowa's 99 counties received one-page news releases about each kind of farm hazard described in the radio announcements. Extension directors were encouraged to localize the releases and send them to newspapers in their community. At the end of every release, readers were directed to county extension offices, where they could obtain a free fact sheet with more information about the monthly farm safety topic. Additionally a special safety packet was mailed directly to 48 farm media outlets during National Farm Safety and Health Week in September.

The farm safety message changed every month according to seasonal farm tasks. It also corresponded with a farm operator's highest exposure to various agricultural hazards. Exposure was determined by the months in which the largest number of injuries and deaths were reported by the Iowa Department of Public Health from particular hazards.

Table 1. The 1992 Iowa State University Safe Farm campaign topics

Farm Hazard	Month(s) Used	Number of Radio Releases	Number of County Releases	Number of Direct Releases
Fire	January	2	0	0
Livestock	February	4	0	0
Machinery	March	4	5	0
Tractors/travel	April	4	4 (3 related to youth and tractors)	0
Pesticides	May	4	5	0
Pesticides	June	4	4	0
Youth	July	4	6	0
Machinery	August	4	7	12
Flowing grain	September	4	5	8
Tractors/travel	October	4	6	0
Electrocution	November	4	6	0
Stress	December	4	5	0

Identified hazards and months during which they were featured in the campaign included farm machinery, tractors and hazards on public roads, pesticides, flowing grain, and electrocution from overhead lines during equipment transfer (table 1). One month was devoted to youth safety because approximately one of every five farm-related injuries in Iowa involves someone under age 19 (Currier et al., 1990). During low-production periods, messages focused on year-round hazards such as fire and livestock, or on general safety concerns including stress.

Each fact sheet (except stress) indicated the number of injuries and fatalities on Iowa farms attributed to a certain farm hazard or condition and suggested ways to reduce or eliminate the hazard. News releases followed a similar format.

News media coverage was tracked using monthly reports from the Iowa Press Clipping Bureau.* The frequency of PSA broadcasts was determined from telephone interviews of 77 station managers representing 116 AM and FM radio stations.†

* News media coverage was tracked using monthly reports from the Iowa Press Clipping Bureau that monitors 340 Iowa weekly and daily newspapers. The service provided 1,877 clippings about farm safety in 1992, a 70% increase from 1991. Of that increase, approximately 60% was from ISU Extension sources.

Approximately 400 clippings could be traced directly to campaign news releases, representing a cumulative circulation of 3.13 million newspaper subscribers. The clippings originated in 40 of Iowa's 99 counties. Releases in the National Farm Safety Week packet generated clippings and represented a cumulative circulation of 1.9 million subscribers. Approximately 500 clippings about general farm safety awareness could not be tied directly to campaign materials but may have been the result of interest generated by campaign activity.

† Ninety-two percent of the 77 station managers representing 116 AM and FM radio stations were surveyed by telephone at the end of the campaign. Of those who responded, 55.7% reported airing the PSAs at least three times a week or more throughout the year. Average PSA use among all stations was about 40 airings per month, which includes heavier use during National Farm Safety Week in September. An average airing of 30 s by those stations would generate at least 180 h of air time on more than 100 Iowa radio stations.

Conceptual and Theoretical Framework

Our approach assumes that investigations of prevention campaigns — or of any purposive communication phenomenon — toward policy-related ends will be most productive in an explanatory way if investigations entail more than only basic description of audience types and requisites as related to campaign exposure, or only possible outcomes of such exposure in terms of direct effects. Rather, at a minimum, such research should include an interactive process approach containing all such components.

The campaign in general, and the PSAs in particular, presented citizens with a diversified range of appeals, content areas, media formats, and suggestions for actions. Here, we have considered those farm safety orientation and behaviors that the campaign would seem to have had the greatest potential for influencing.

The campaign was largely concerned with effecting increased citizen competence in helping reduce injuries on farms. The term "prevention competence" serves as an organizing rubric of this study which encompasses several kinds of orientations and behaviors through which citizens may demonstrate their ability to prevent farm injuries. Prevention competence is likely to increase among farm operators to the extent that they (1) are more fully aware of effective prevention techniques; (2) hold positive attitudes about the effectiveness of self-initiated prevention activities and about their own responsibility for getting involved in prevention; (3) feel capable about carrying out actions themselves that reduce their chances of victimization; (4) are concerned about protecting themselves and others from farm injuries; and (5) actually engage in actions aimed at reducing farm injuries (McGuire, 1969; Cialdini et al., 1981; Solomon, 1981).

Thus, prevention competence includes the same general constellation of dependent variables often found in communication effects and persuasion studies. With varying degrees of conceptual sophistication, persuasion is usually seen as at least a four-step process involving (1) the building of awareness or knowledge; (2) the inducement of attitude changes; (3) motivating individuals towards desired behavior by generating interest or concern; and, finally, (4) effecting desired behavioral changes.

Although this sequence of potential campaign-induced events has a nice logic about it, rarely can even well-designed and carefully targeted media campaigns be expected to induce changes on their own along all of the above dimensions. For one thing, the degree to which persuasion may occur is highly dependent upon existing audience dispositions concerning the topic or issue at hand. Some issues are simply more change-resistant than are others. When media campaigns in and of themselves are effective to any degree, it is more likely to be in terms of providing increased knowledge or, perhaps, in changing attitudes.

As have been demonstrated empirically (Bandura, 1977; Solomon, 1981; McAlister et al., 1980), people are more likely to act on information acquired from mass media sources when appropriate social and environmental supports are present. Therefore, an explicit causal model (Daniels 1993, unpublished AHPS project report, Iowa State University, Ames Iowa) of farm safety behavior was used (fig. 1). In the model, operator characteristics, awareness of farming dangers, concern over farming hazards, and practice of farm safety are linked directly to awareness, concern, and practice variables in 1992. Significant changes in awareness, concern, and behavior systematically related to the Safe Farm campaign were anticipated.

It is important to note that the Safe Farm campaign was aimed at the public in a highly diversified manner. A reasonable possibility exists that the campaign would

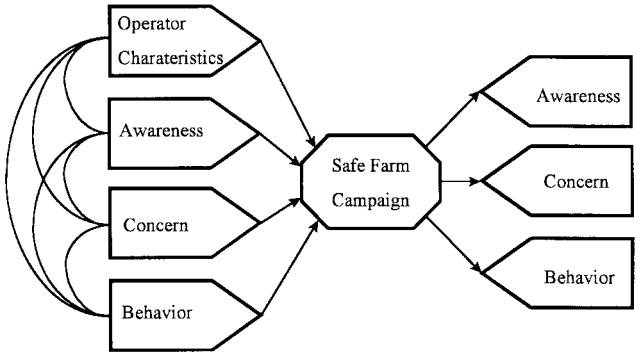

Figure 1–Causal model of farm safety study (Daniels, 1993, unpublished AHPS project report, Iowa State University, Ames Iowa).

have scattershot influences on various types of people depending upon their existing orientations toward farm accident prevention — perhaps simply informing some, changing selected attitudes in others, making still others more concerned, and perhaps triggering some into action.

Methods

The nature of the Safe Farm campaign presents several obstacles to well-controlled evaluation of its effects on citizens. The PSA format renders placement of specific ads within specific locales over the state quite haphazard and dependent upon the willingness of media outlets to incorporate them as space and time permit. Moreover, the design of the campaign made no allowance for attempted dissemination of the PSAs in particular communities, while withholding the messages from others, making classic "treatment versus control community" field experiment controls impossible. Thus, our overall research effort is based upon the best design options available: (1) the use of a statewide sample survey to determine the reach or penetration of the campaign over the state as a whole; and to examine citizen self-evaluations of the impact and effectiveness of the campaign, and (2) the incorporation of a panel survey in which respondents surveyed in 1991 prior to the campaign's releases were resurveyed in 1993 for the purpose of examining changes in their farm safety orientations and attempting to track those to exposure to the campaign.

The baseline and follow-up telephone surveys of 460 Iowa farm operators were conducted by the ISU Statistical Laboratory. Operators were contacted by telephone in December 1991 to gather information about farmers' attitudes, knowledge, and behavior regarding safety. The second survey, conducted in early 1993, determined what changes, if any, had taken place and gauged farmers' recall of Safe Farm campaign messages.

The initial sample size for the statewide baseline survey was 1,639 Iowa farm operators randomly drawn from the Farm and Home Directory and Plat and TAM Service Rural Directory (1991). Because the goal was to include a large number of Iowa's 99 counties, the sample was spread over 50 counties, including 39 counties with the largest estimated number of eligible farms. An additional 11 counties were selected from the 60 remaining counties using probabilities proportional to their sizes.

Of the first 1,390 contacted, 584 met the screening criteria of (1) being a farm operator, (2) having 40 acres of crop land or raising livestock for sale, and (3) intending to farm in both 1991 and 1992. All 584 completed an approximate 30-min telephone interview. The remaining 249 households in the initial sample were not contacted. The first 30-min telephone interview yielded responses from 517 farm operators (66 refused to participate and one was not competent to participate from the 584 interviewed). The number of responses from the follow-up survey was lower than the baseline survey. The original baseline sample was reduced to 460 responses (41 refused to participate in the follow-up survey and 16 ceased farming). Farmers were asked to identify the most threatening hazards to them and their families. They also were asked about injury experiences, current safety practices, and preferred sources of safety information.

The baseline survey covered farm operator and operation characteristics, general awareness of the dangers of farming, concern over farm safety hazards, the incidence of accidents involving farm personnel, the practice of specific farm safety techniques, sources of information about farm safety, and the degree of change in farm safety practices produced by either information or past injuries in 1991 and earlier years.

The follow-up survey repeated many of the same baseline questions, but also included questions concerning the operator's receipt of farm safety messages from various sources in 1992. The questionnaire included aided and unaided recall measures of exposure to the campaign. The potential effects of that exposure in terms of changes in orientation toward farm safety and injury prevention was examined by means of simple before and after group comparisons, and by more stringent multivariate control procedures.

Results

There are several factors that might have some bearing on farmers' attitudes and behaviors toward farm safety. These factors fall under the following categories.

Farmer-operator Characteristics

Farmers' personal characteristics, work effort, type of operation, and financial characteristics all impinge on their "susceptibility" to safety messages.

Personal characteristics include experience in farming and level of education, both of which should improve their ability to gather and use information about farm safety. In general, the two surveys showed that Iowa farm operators have considerable farming experience. They had worked an average 37 years on a farm, 23 of these as farm operators. A majority of the respondents (51.8%) had high school diplomas and an additional 23.6% had some college.

The typical Iowa farm operator put in more than normal effort in on-farm and off-farm work to make ends meet, reporting an on-farm work effort of 91.3% in 1992 (s.d. = 19%) and an additional 26.7% of their time devoted to off-farm duties (s.d. = 39.6%). It was expected that greater work effort on the farm would be related to greater safety, whereas, greater work effort off the farm would be a distraction and would reduce safety.

Farm operations were classified into two types: crop and livestock. It is hypothesized here that crop operations, because of their greater use of equipment and chemicals, may elicit more safety concerns than livestock operations. Only 18 of the 460 farm operations reported not having crops and 85 operators said they had no livestock.

The operation's financial status might also affect the acquisition and use of safety information. That is, to the extent that farming is the source of income, operators will be more focused on, and hence, more safe with his or her operations. The typical farm operator reported receiving approximately 59.7% of his or her total income from farming (s.d. = 33.1%).

Information Sources

Both confirmatory factor analysis and principal components analysis performed on the 1991 data revealed that Iowa farm operators tended to organize information by who provided the information rather than how the information was delivered. The analysis identified four major factors: extension; dealers, producers, and suppliers; the media; and friends, neighbors, and family. The analysis assumed that increased information from any source should reduce injuries and enhance awareness, concern, and safe practices.

The baseline survey showed that farm operators relied heavily on local media as well as the cooperative extension service for farm safety information. When asked where they get safety information, 95% of the respondents said they receive them from newspapers and magazines, 82% from radio, 77% from television, 59% relied on publications from Iowa State University Extension, and 33% relied on ISU Extension staff (fig. 2). These findings suggested that it was feasible to distribute messages through the local radio and weekly newspapers that respondents attend to; these would then be reinforced by educational resources within the extension network.

Safety Attitude and Behavior

Respondents' safety behaviors and their attitudes toward farm safety were measured with four indices used in 1991 and 1992.

Awareness Index. This index, designed to measure awareness to farm safety issues, is composed of the following attitude scales common to both surveys:

- Farming is more dangerous than being a construction worker.
- Too many farmers do not use protective clothing or equipment when farming.
- The information about farm hazards and injuries exaggerate the dangers of farming.
- Many farmers take more risks than I do when operating their machinery.

Farm operators responded to each question on a four-point scale ranging from strongly agree to strongly disagree. For each year, the four items combined to

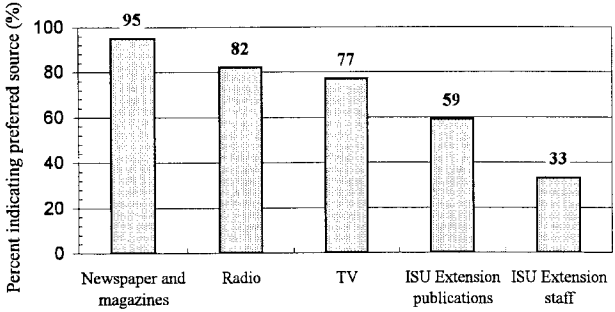

Figure 2–Preferred sources of information from baseline survey (n = 517).

Table 2. Changes in farm safety awareness, concern, and behavior indices, 1991-1992

Variables	1991 Mean	1992 Mean	No. of Cases	Significance (One-tailed)
Awareness index †	67.25	68.88	460	0.035 *
Concern index ‡	78.50	79.91	453§	0.011 *
Behavior index ||	73.01	74.17	443§	0.020 *

* Statistically significant $p < 0.05$.
† Awareness index is an additive composite of four scales concerning the dangers of farming.
‡ Concern index is an additive composite of seven questions dealing with the hazards of farming.
§ The number of cases is different from the total number of responses (460) because some participants refused to answer every question and cases with incomplete indices were dropped from the statistical analysis.
|| Behavior index is an additive composite of seven questions on farm safety behavior.

produce an additive index. The index was then re-coded by subtracting five and multiplying by 100/15 to range from 0 to 100. In 1991, the mean awareness was 67.25. The alpha was low ($\alpha = 0.247$). In 1992, the mean awareness increased slightly to 68.88. The alpha improved slightly, but remained low ($\alpha = 0.365$). A paired t-test showed that scores on this scale were statistically higher in 1992 than in 1991 (table 2).

Concern Index. This index combined responses to seven attitude scales common to both surveys regarding operator concern about seven common agricultural hazards. Operators were asked to indicate their concern on a scale of 1 to 10, with 10 indicating maximum concern. The questions asked how concerned farmers are about

- Tractor rollovers?
- Injuries caused by falls?
- Getting clothing caught in a power take-off or any machinery?
- Electrocution?
- Pesticide exposures or spills?
- Accidents with anhydrous ammonia?
- Suffocation in a grain bin or wagon?

Answers were coded on a 100-point scale.‡ Mean values for 1991 and 1992 concern scales were 78.50 and 79.91, respectively. A paired-difference t-test showed that farm operator scores were statistically higher in 1992, compared to 1991 (table 2).

Behavior Index. This scale combined scores on the two farm equipment safety scales and scores on 11 questions common to both surveys that asked about behaviors that contribute to safety. First, operators were asked whether they had either one of two safety devices on their tractor: a seat belt and a rollover protection structure (ROPS). Then they were asked how frequently they:

- Have their PTO shafts protected by shields?
- Enter a wagon or truck that has flowing grain?

‡ For each of the hazards, respondents expressed their concern on a scale from one to 10, with 10 indicating maximum concern. For 1991 and 1992, the scores for the seven hazards were summed. To this figure, seven was subtracted and the result was multiplied by 100/63 to re-calibrate the concern scale to range from 0 to 100. In 1991 the mean level of concern was 78.2 (s.d. = 18.3). In 1992 the mean level of concern rose to 79.9 with a standard deviation of 18.0. The difference between the 1991 and 1992 scales ranged from –73.0 to 57.1 and averaged 1.4 (s.d. = 13.1).

- Have the "Slow Moving Vehicle" signs on their farm equipment when out on the road?
- Maintain the safety devices on their machinery?
- Turn off the engine when adjusting, cleaning or unplugging equipment?
- Ventilate to remove hazardous gases before entering silos, a manure pit, or other places where gases accumulate?
- Restrain livestock when they are working on them?
- Check to ensure that no one is in the grain bin before they unload?
- Wear hearing protection around noisy equipment?
- Teach people who work on the farm about the safe operation of farm equipment?

They were asked how careful they think they are around the farm on a scale of 1 to 5 where 1 means "very careful" and 5 means "not careful at all." Answers to these questions were coded on a 100-point scale. Mean values for this scale in 1991 and 1992 were 73.01 and 74.17, respectively. A paired-difference t-test showed that scores on this index were statistically higher in 1992 than in 1991 (table 2).

Operators consider themselves to be "very aware" of farm dangers but do not consider themselves "very careful", an aspect that did not change much in 1992. However, they did report adopting more safety practices, such as shielding power take-off units, never allowing extra riders on tractors, always checking grain bins before unloading, and maintaining safety devices on machinery.

Injury Index. The surveys queried farm operators concerning all past injuries and injuries in 1992, recognizing that its impact may be unclear. On the one hand, past injuries may have sensitized farm operators to past unsafe practices and led to change, which should have reduced future injuries. On the other hand, past injuries may have been indicative of unsafe attitudes and behavior that may have predicted future injuries. The final score ranged from zero to two, and averaged 0.64 (s.d. = 0.70)§. The analysis summed the 1992 scale using a similar procedure, and averaged 0.10 (s.d. = 0.29).

First hand or close-at-hand injuries are common in Iowa farms. Thirty-seven percent (192) of the respondents claim they had been involved in a farm injury or chemical spill and 26% (134) had worked or lived with a farm injury victim. About 40% of the injuries involved tractors or machinery, 14%, falls, and 16% involved animals.

Farm Safety Program Intervention

To test the impact of the Safe Farm campaign, farm operators in the 1992 survey were asked if they remembered the sources, topics, and sponsors-distributors-presenters of the safety messages they know. Some questions were asked specifically about messages received from ISU Extension. Operators said what they know about farm safety they had learned from newspapers and radio.

The most common type of sponsor or presenter identified was ISU Extension. Other sources mentioned were non-extension media, public agencies, utilities, not-for-profit organizations, and private sponsors.

§ A prior injury scale was created by coding the 1991 questions as one for yes and zero for no, and summing for the operator and other farm workers.

Analysis

The campaign's effects could be measured in two stages. First, it is important to know whether significant differences occurred between 1991 and 1992 on key farm safety variables. Second, the sources of those differences must be identified. The first stage could be done by using paired t-tests on those farm safety variables with comparable 1991 and 1992 indicators. The second stage could be assessed by running regressions based on the causal model identified in figure 1.

Difference in Means

Three indices had common indicators in 1991 and 1992: the Awareness Index, Concern Index and Behavior Index. All three significantly increased between 1991 and 1992, suggesting that changes in farm safety attitudes and behavior occurred between 1991 and 1992. However, we cannot attribute these changes to the farm safety promotional campaign without further analysis. For example, awareness, concern, and behavior could easily have been expanded by attention from other non-extension sources. Moreover, the increase in the number of tractors with roll bars and seat belts could have simply been the result of replacing older tractors with newer ones. Will these results withstand a more powerful multivariate test?

Causal Analysis of Farm Safety Attitudes and Behaviors

To sort out the factors producing these changes, multiple regression analyses were conducted based on the causal model in figure 1. The regressions modeled 1991-1992 differences on the awareness, concern and behavior. Table 3 details the results of the difference regressions. The overall effect of each coefficient adjusting for all other coefficients in the equation appears in table 4. Here, the coefficients represent the percentage change in the value of the dependent variable produced by a standard deviation change in the independent variable.

Overall, some consistent patterns of influence appeared in the various regression equations. Across the three dependent variables representing 1992 farm safety attitudes, only 5 of 21 coefficients for operator characteristics were significant, an outcome that could have occurred by chance. By contrast, behavior in 1991 holds a clear relationship with behavior in 1992. In general, awareness in 1991 contributed significantly to awareness in 1992 and concern over safety hazards in 1992. Concern in 1991 translated into significantly higher levels of concern and behavior in 1992.

The differential impact of various information sources is apparent. Operators who received information about farm safety from dealers, producers, or suppliers generally had lower levels of awareness and concern about the dangers of farm safety. Information about farm safety garnered through the media significantly increased concern about safety hazards.

Despite these promising statistics, the 1992 safety campaign itself had few significant effects. Generally, the significant coefficients for 1992 general and ISU sources and sponsors across all equations had no substantive pattern. The null hypothesis that the pattern of significance was largely the result of random chance could not be rejected.

Most of these conclusions were confirmed by the difference equations. The sign and magnitude of the regression coefficients for the safety differences between 1991 and 1992 were comparable to those for the 1992 equations. The sole exceptions were the negative effects of 1991 safety attitudes and behavior on 1991-1992 differences and the lack of effect of receiving information from ISU sources (1991) on behavior. The former were largely statistical artifacts representing regression to the mean.

Table 3. Coefficients for the independent variables used in the multiple regression of the 1991-1992 difference indices

Independent Variables	1991-1992 Differences		
	Awareness Index †	Concern Index ‡	Behavior Index §
Operator Variables			
Type of farming:			
Crop (median)	–0.05	0.04	0.01
Livestock (median)	0.03	–0.00	–0.01
Work Effort:			
On-farm ratio	0.03	–0.02	–0.07*
Off-farm ratio	–0.01	–0.01	–0.02
Financial:			
% income from farming	0.01	0.01	-0.02
Experience:			
Years farming	–0.01	0.12*	0.02
Education	0.54	–0.72	0.52
Safe Farm Campaign			
1991 info. sources:			
ISU Extension	–0.09	0.03	-0.78
Dealers/producers	–1.50*	–0.99*	–0.28
Media	0.48	1.80*	1.03
Family, friends	–0.16	1.04	0.71
1992 info. sources:			
Radio	4.82*	1.62	1.18
Newspapers	0.37	0.83	0.20
Brochures	–2.71	–0.17	–0.82
Meetings, etc.	6.22*	2.05	2.29
1992 sponsors:			
Extension	–0.65	–0.66	–0.60
Other media	–3.04	–1.70	–0.06
Public agencies	5.51	1.97	0.15
Utilities	1.43	–0.92	0.29
Not-for-profit org.	–1.43	–1.44	–3.25*
Private org.	–1.51	0.39	-0.70
1992 ISU sources:			
Written materials	–0.35	–0.88	0.06
Radio	–0.07	2.29	-1.75*
1991 awareness	–0.50*	0.06*	0.01
1991 concerns	0.07	–0.65*	0.10
1991 behavioral	0.08	0.04	-0.37*
Previous injuries	2.45	0.90	-0.09
Safety issues 1992:			
Reduce hazard	0.09*	0.15	0.01
Constant	9.09	2.33	25.1*
Summary			
No. of cases	410||	407||	410||
R-squared	0.28	0.27	0.27
F-Ratio	4.85	4.53*	4.44*

* Coefficients that are statistically significant $p < 0.05$.
† Difference between 1991 and 1992 Awareness Indices.
‡ Difference between 1991 and 1992 Concern Indices.
§ Difference between 1991 and 1992 Behavior Indices.
|| The number of cases is different from the total number of responses (460) because some participants refused to answer every question and cases with incomplete indices were dropped from the statistical analysis.

Table 4. Effect coefficients for the independent variables used in the multiple regression of the 1991-1992 difference indices†

Independent Variables	1991-1992 Differences: Awareness Index ‡	Concern Index §	Behavior Index ||
Operator Variables			
Type of farming:			
Crop (median)	–1.01	0.96	0.32
Livestock (median)	0.72	–0.01	–0.46
Work effort:			
On-farm ratio	0.38	–0.34	–1.63*
Off-farm ratio	–0.34	–0.41	–1.04
Financial:			
% income from farming	0.33	0.33	-0.75
Experience:			
Years farming	–0.10	1.26*	0.30
Education	0.40	–0.54	0.61
Safe Farm Campaign			
1991 info. sources:			
ISU extension	–0.07	0.02	-0.98
Dealers/producers	–1.29*	–0.87*	–0.39
Media	0.26	0.99*	0.89
Family, friends	–0.10	0.67	0.72
1992 info. sources:			
Radio	2.17*	0.75	0.86
Newspapers	0.20	0.45	0.17
Brochures	–0.91	–0.06	–0.45
Meetings, etc.	1.96*	0.66	1.16
1992 sponsors:			
Extension	–0.31	–0.32	–0.46
Other media	–0.75	–0.43	–0.02
Public agencies	0.99	0.36	0.04
Utilities	0.25	–0.16	0.08
Not-for-profit org.	–0.33	–0.34	–1.21*
Private org.	–0.73	0.19	-0.54
1992 ISU sources:			
Written materials	–0.17	–0.43	0.05
Radio	–0.03	0.93*	-1.12*
Safety issues:			
1991 awareness	–6.88*	0.84*	0.15
1991 concerns	0.95	–9.18*	2.17*
1991 behavior	0.83	0.41	-6.14*
Previous injuries	1.29	0.48	-0.08
Safety issues 1992:			
Reduce hazard	1.08*	1.97*	0.11

* Coefficients that are statistically significant $p < 0.05$.
† The figures in the tables represent the percentage change in the dependent variable associated with a one-standard deviation change in each independent variable, controlling for all other factors.
‡ Difference between 1991 and 1992 Awareness Indices.
§ Difference between 1991 and 1992 Hazard Concern Indices.
|| Difference between 1991 and 1992 Behavioral Safety Indices.

That is, individuals who had high scores on safety in 1991 made fewer changes in attitude and behavior than those with lower scores. However, because all of the indicators had upper and lower limits, individuals with high scores had much less range to cover. Thus, negative coefficients were inevitable. The lack of effect of

receiving information from ISU sources was more troublesome because it weakened our conclusions about the potential effect of ISU extension.

Summary and Conclusions

The foregoing analysis leads to several conclusions. First, significant improvements in safety attitudes and behaviors occurred between 1991 and 1992 among Iowa farm operators with more than 40 acres. These changes were apparent for awareness, concern, and behavior. Little significant variation occurred in the overall quantity of safety changes actually made by operators. Second, these changes probably could not be statistically attributed to the Safe Farm campaign. Few significant effects are apparent in tables 3 and 4. Third, the absence of significant effects for the campaign could be the result of poor measurement as well as absence of true effect. The indicators of the campaign are all recall items with considerable measurement error. Fourth, ISU extension appears to have a positive effect on safety changes among Iowa farm operators; however, these effects appear only when explaining 1992 safety attitudes and behaviors, not when evaluating differences in attitudes and behaviors between 1991 and 1992.

The variables used in this study combined several different types of safety messages into single indicators. These indicators may have obscured important influences specific to particular safety topics, such as machinery safety or chemical safety. Further analysis should separate out the more specific effects. Of equal importance may be the reciprocal relationship between the campaign and safety attitudes/behaviors. The model explored in this study assumes that the safety campaign influenced 1992 safety and 1991-1992 safety differences. In fact, 1991 safety may have influenced respondent sensitivity to the safety campaign. This possibility needs further exploration.

So, too, is the possibility of evaluating the campaign further along in the response chain. It is possible that a year-long campaign may not be long enough to register an impression among audience groups. A multiple time series design will be helpful in elucidating lasting campaign effects.

Beyond the current data set, further study of the effects of safety promotional campaigns is necessary. Several of the indicators in the current study had serious shortcomings as measures of effectiveness. In addition, the questions measuring specific safety changes based on information and number of injuries do not allow assessment of change over time. With proper replication and improved measurement, better appraisal of the effects of promotional campaigns becomes possible.

References

Aherin, R. A., D. Murphy and J. Westaby. 1990. Changing farm worker behavior: A literature review of injury control strategies. ASAE Paper No. 90-1620. St. Joseph, Mich.: ASAE.

Bandura, A. 1977. *Social Learning Theory.* Englewood Cliffs, N.J.: Prentice-Hall.

Burke, J. 1987. Historical overview of the agricultural safety movement. ASAE Paper No. 87-5512. St. Joseph, Mich.: ASAE.

Cialdini, R. , R. Petty and J. Cacciopo. 1981. Attitude and attitude change. In *Annual Rev. of Psychology,* eds. M. Rosenzweig and L. Porter, Vol. 32. Palo Alto, Calif.: Annual Reviews.

Contant, C. K. 1991. Communicating to effect behavioral change: A framework for public education programs. *J. Planning Education and Res.* 10(2):89-97.

Currier, R., J. Muldoon, S. Jones and D. Anthony. 1990. Surveillance of agricultural related injury in Iowa: Annual Data 1990. Des Moines, Iowa: Iowa Department of Public Health, Division of Disease Prevention.

Klapper, J. 1960. *The Effects of Mass Communication*. New York, N.Y.: Free Press.

Layde P. 1990. Beyond surveillance: Methodology considerations in analytic studies of agricultural injuries. *Am. J. Ind. Med.* 18:193-200.

Lexau, C., L. Kingsbury, B. Lenz, C. Nelson and S. Voehl. 1993. Building coalitions: A community-wide approach for promoting farming health and safety. *Am. Assoc. Occ. Health Nurses J.* 41(9):440-449.

McAlister, A., P. Pekka, K. Koskela, U. Pallonen and N. Macoby. 1980. Mass communication and community organization for public health education. *Am. Psych.* 35:375-379.

McGuire, W. 1969. The nature of attitudes and attitude change. In *Handbook of Social Psychology*, eds. G. Lindsey and E. Aronson. Reading, Mass.: Addison-Wesley.

National Institute of Mental Health. 1982. *Television and Behavior: Ten Years of Scientific Progress and Implications for the Eighties.* Washington, D.C: NIMH.

O'Keefe, G. J. and L. E. Atwood. 1981. Communication and election campaigns In *Handbook of Political Communication*, eds. D. Nimmo and K. R. Sanders. Beverly Hills, Calif.: Sage.

Oskam, J. B. 1993. Fields of danger: Communicating agricultural safety and health information. *J. Appl. Commun.* 76(2):1-8.

Rosenblatt, P. C. and Paul Lasley. 1991. Perspective on farm accident statistics. *J. Rural Health* 35:51-61.

Skromme, A. B. 1990. A farm safety program sponsored by farmers. ASAE Paper No. 90-1621. St. Joseph, Mich.: ASAE.

Solomon, D. 1981. Social marketing and health promotion. In *Public Communication Campaigns*, eds. R. E. Rice and W. J. Paisley. Beverly Hills, Calif.: Sage.